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they had coiled young stages similar to those of the normal forms from which they must have originated.

The correlations of Nostology can only be artificially separated from those of Clinology, but there existed one class of forms which can be compared only with the nostologic stage. These are the degenerate straight Baculites-like shells, which belong to several distinct genetic series and should often be widely separated on that account. Their resemblances are undoubtedly close, but they are due to degeneration and, therefore, simply homoplastic. Naturalists sooner or later will begin to recognize that degeneration may produce close representation in forms having distinct origins. The Baculities is a smooth, straight, cylindrical though slightly compressed shell, which has so completely reverted that it resembles an Orthoceras, though it is an unquestionable Ammonoid of the Jura and Cretaceous.

THE POISON-APPARATUS OF THE MOSQUITO.

BY PROFESSOR G. MACLOSKIE.

THE oral armature or proboscis of the mosquito (*Culex*) is described and figured in Dimmock's *Mouth-parts of Some Diptera*, and consists of a labrum, two mandibles, two maxillæ, surrounding a hypopharynx, and all these enclosed in a loose scale-covered sheath, which is the labium. They are nearly three millimetres long, about four times as long as the head; and all except the sheath are smooth, chitinous stylets. The maxillæ bear maxillary palps, scaly, four-jointed, about as long as the head in *Culex*, and three times as long in the allied genus *Anopheles*. I have only to add to Dimmock's description that besides the somewhat coarse serration of the maxillæ (about fifteen teeth near the top of each), Minot S. Morgan, of Princeton, has shown very fine serrations on the upper part of the mandibles (about forty-two minute teeth on each).

The hypopharynx is in the axis of all these mouth parts, being inserted by a basal enlargement close behind the oral aperture, and

flattened so as to form the floor of a sucking tube whose sides and roof are formed by the grooved labrum (or labrum-epipharynx according to Dimmock). This sucking tube extends back in the head, piercing between the upper and lower brain, and enlarged in the posterior part of the head into a large pumping organ, which forces the imbibed fluid backwards into the œsophagus and stomach.

In the last century Reaumur thought he could detect a drop of saliva ejected by the proboscis when stinging; he supposed that this is poisonous, and that its special function is to prevent the coagulation, and thus to promote the flow of blood by suction when the insect operates on our skin. We do not believe that he possessed any instrument that could show the poison; but his inference as to the presence of poison and its function is almost certainly correct. It seems to us, however, that the chief food of this insect is not animal blood, but the proteids of plants; and probably the fluid ejected may prevent the coagulation of all proteids, and so promote the process of suction.

It has been very often suspected that the poison-duct is contained in the hypopharynx, which has a thickened axis, like a rod, supposed by some observers to be tubular. Dimmock made out the tubular character of the corresponding part of some of the larger non-poisonous Diptera, but he was not able to demonstrate its tubular character in Culex. In addition to his observations that go to prove the existence of poison in its bite, I may add my own observation, that even when failing to draw blood its bite will sometimes swell the part, the subcutaneous tissue being irritated by poisonous matter. He concludes from the careful examination of all the parts that no other channel can conduct this poison; and adds, "This, together with the position occupied by the salivary duct in other Diptera, leads me to believe, without as yet being able to give anatomical proof of it, that the hypopharynx of Culex contains a duct that pours out its poisonous saliva"; and he further states that he was unable to determine the actual presence of the glands.

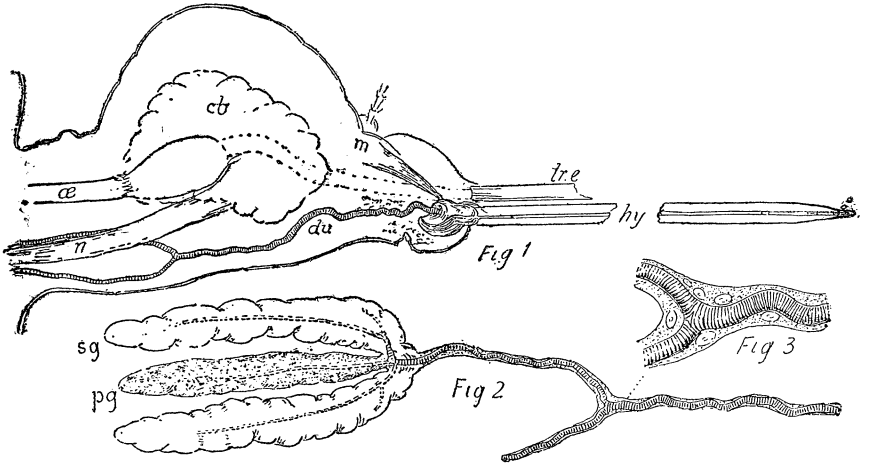
A year ago I succeeded in making out the duct and also the glands, and published a preliminary note; I was unable, however, at that time, to correct errors or to complete the work. This

past summer, however, gave me an opportunity of revising the subject, so that I have acquired some facility in finding and dissecting the parts. I find that it is even easy to see the venomo-salivary duct from the outside, shining through the skin at the base of the head and neck in the undissected specimen. Also, thanks to the supervision of Professor Libbey and the manipulation of Dumas Watkins, of Princeton Histological Laboratory, I have been supplied with a set of excellent sections, which show the relations of the parts. One of these sections is here engraved in part (Fig. 1), exhibiting the insertion of the duct into the base of the hypopharynx, and its course below the nerve. I have also teased out and stained some of the glands, which have enabled me to show their structure and relations, as in Fig. 2.

The secret was first discovered by an observation of fine droplets of a yellow, oily-looking fluid escaping from the apex of the hypopharynx (Fig. 1). I was then able to trace the course of this fluid down through the axis of the hypopharynx, its being divided in parts into droplets, and so indicating the tubular structure of this organ. On examining the base of the hypopharynx I found it to be enlarged like the mouth of a trumpet, and provided with a sac-like reservoir, into which the end of a fine duct was inserted. Working backwards I saw the duct to be of the usual character of salivary ducts in the Diptera, but much finer than usual, being less than eight microms in diameter, against thirty-seven microms in the house-fly.[1] It is not readily identified by a low microscopic power, and this may explain why it has not been previously detected. It has the usual chitinous lining, surrounded by the nucleated hypodermis which secretes it, transversely striated as in tracheæ (Fig. 3); but it is distinguished from the tracheæ by the comparative smallness and constancy of its diameter, and by the absence of ramifications. It runs back in the lower part of the head, beneath the nervous commissure (*n* in Fig. 1), for two-fifths of a millimetre. In the throat it bifurcates, its two branches being each as long as the undivided segment, and running on the right and left of the nerve-cord into the prothorax, where they terminate in glands of characteristic structure.

[1] A microm is one-thousandth part of a millimetre, or one-twenty-five-thousandths of an inch.

The glands are in two sets, one on each side in the antero-inferior region of the prothorax. Each set consists of three glands, two of which are of the usual aspect of salivary glands, resembling in structure, but not proportionately as long as, the single salivary gland on each side in the prothorax of the house-fly. The third gland, that occupying the centre of each set, is different, being evenly granular, and staining more deeply than the others; its function being without doubt the secretion of the poison. Each gland is about one-third of a millimetre long, and one twenty-fifth of a millimetre broad; the three are arranged like the leaves of a trefoil; and each is traversed throughout by a fine ductule, the three ductules uniting at the base to form a common duct, which is like a pedicel of the trefoil and is one of the branches of the bifurcated venomo-salivary duct. The ductules of the lateral glands of each set receive a minute branchlet near the base. Thus there are six glands, three on each side, two of them poisonous and four



EXPLANATION OF FIGURES.—Fig. 1. Median section of head, showing (*du*) the venomo-salivary duct, with its insertion in (*hy*) the hypopharynx: *cb*, cerebrum; below this is the cerebellum, and the pumping enlargement of (*œ*) the œsophagus: (*lr. e.*), base of labrum-epipharynx; (*m*) muscle; (*n*) nerve-commissure. Other parts removed.

Fig. 2. The venomo-salivary duct, showing its bifurcation, and the three glands on one of its branches: (*pg*) poison-gland; (*sg*) marks the upper of the two salivary glands.

Fig. 3. The bifurcation of the duct, with its nucleated hypodermis.

salivary, their secretion diluting the poison. The two efferent ducts, one from each set of glands, carry forward and commingle the venomo-salivary products in the main duct: and the stream is then carried by the main duct to the reservoir at the base of the hypopharynx. There is no other exit for the contained fluid. I see muscles apparently inserted on the frame-work of this reservoir (Fig. 1, *m*); but Dimmock seems to think that the hypopharynx is not furnished with muscles. However this may be, the pressure exerted on it by the surrounding parts, when the mosquito inserts its piercing apparatus into the flesh or through the epidermis of a plant, is sufficient to propel the poison through the tubular axis of the hypopharynx into the wound. The reservoir must be furnished with a valve to prevent the reflux of the secretion. The distal orifice of the hypopharynx is not exactly terminal, but sub-apical, as is usually the case with fangs; the very tip is somewhat flattened and sharp, so as to enter easily into and to enlarge the wound made by the adjoining organs.

Careful observations are needed as to the behavior of mosquitoes on plants; as to the condition of the hypopharynx and the glands in the males and in the larvæ. The observations here noted were made on the adult females of Culex (*C. tæniorhynchus* Desv.), and on a species of the allied genus *Anopheles*, which is characterized by its long maxillary palps.

Princeton College, Sept. 18, 1888.

SOMETHING ABOUT CRABS.

BY J. S. KINGSLEY.

CRABBED, crusty, cancer, canker, are terms which at once recall to most persons various disagreeable features and more serious ailments of human beings; to the naturalist they at once suggest the crabs and the group Crustacea to which these animals belong. There must be some reason why the crabs have thus acquired this bad name which goes even farther than indicated above. They are by common consent regarded as ill-tempered, ready to pinch